

### Claims

1. A catalyst system for the production of acetic acid which catalyst system comprises an iridium carbonylation catalyst, methyl iodide co-catalyst, optionally at least one of ruthenium, osmium, rhenium, zinc, gallium, tungsten, cadmium, mercury and indium and at least one non-hydrohalogenoic acid promoter.
- 5 2. A catalyst system according to claim 1 wherein the non-hydrohalogenoic acid is selected from an oxoacid, a superacid, a heteropolyacid and mixtures thereof.
3. A catalyst system according to claim 2 wherein the non-hydrohalogenoic acid is an oxoacid.
4. A catalyst system according to claim 3 wherein the oxoacid is an oxoacid of the elements of Groups 13 to 17 of the Periodic Table.
- 10 5. A catalyst system according to claim 3 or claim 4 wherein the oxoacid is selected from  $H_2SO_4$ ,  $HNO_3$ ,  $H_3PO_4$  and mixtures thereof.
6. A catalyst system according to any one of claims 3 to 5 wherein the molar ratio of oxoacid anion to iridium is in the range [greater than 0 to 0.4] : 1.
- 15 7. A catalyst system according to claim 5 wherein the molar ratio of oxoacid anion to iridium is [greater than 0 to 0.35] : 1, such as in the range [0.05 to 0.3] : 1.
8. A catalyst system according to claim 2 wherein the non-hydrohalogenoic acid is a superacid.
9. A catalyst system according to claim 8 wherein the superacid has a non-20 coordinating anion to iridium.
10. A catalyst system according to claim 8 or claim 9 wherein the superacid is a superacid having an anion selected from  $BF_4^-$ ,  $PF_6^-$ ,  $(CF_3SO_2)_2N^-$ ,  $CBH_6Br_6^-$ ,  $CF_3SO_3^-$ ,  $SbF_6^-$ ,  $FSO_3^-$  and mixtures thereof.

11. A catalyst system according to any one of claims 8 to 10 wherein the superacid is selected from  $\text{HBF}_4$ ,  $\text{HPF}_6$ ,  $(\text{CF}_3\text{SO}_2)_2\text{NH}$ ,  $\text{HCBH}_6\text{Br}_6$  and mixtures thereof.
12. A catalyst system according to any one of claims 8 to 11 wherein the molar ratio of the superacid anion to iridium is in the range [greater than 0 to 2.5] : 1.
- 5 13. A catalyst system according to claim 12 wherein the molar ratio of the superacid anion to iridium is in the range [greater than 0 to 1] : 1, such as in the range [0.05 to 0.5] : 1.
14. A catalyst system according to claim 2 wherein the non-hydrohalogenoic acid is a heteropolyacid.
- 10 15. A catalyst system according to claim 14 wherein the heteropolyacid comprises molybdenum and/or tungsten as peripheral atoms.
16. A catalyst system according to claim 15 wherein the heteropolyacid is selected from 12-tungstophosphoric acid, 12-molybdophosphoric acid, 12-tungstosilicic acid, 12-molybdsilicic acid and mixtures thereof.
- 15 17. A catalyst system according to any one of claims 14 to 16 wherein the molar ratio of the heteropolyacid anion to iridium is in the range [greater than 0 to 5] : 1.
18. A catalyst system according to claim 17 wherein the molar ratio of the heteropolyacid anion to iridium is in the range [greater than 1 to 4] : 1, such as in the range [1.5 to 3.5] : 1.
- 20 19. A catalyst system according to any one of claims 1 to 18 which comprises at least one of ruthenium, osmium, rhenium, zinc, gallium, tungsten, cadmium, mercury and indium.
- 20 20. A catalyst system according to claim 19 which comprises at least one of ruthenium, osmium, rhenium and indium.
- 25 21. A process for the production of acetic acid by reacting carbon monoxide with methanol and/or a reactive derivative thereof in a liquid reaction composition comprising methyl acetate, a finite concentration of water, acetic acid and a catalyst system comprising a catalyst system according to any one of claims 1 to 20.
22. A process according to claim 21 wherein the concentration of methyl acetate in the
- 30 23. A process according to claim 22 wherein the methyl acetate concentration is in the range 2 to 50% by weight, such as 3 to 35% by weight.
24. A process according to any one of claims 21 to 23 wherein the concentration of

water in the liquid reaction composition is in the range 1 to 15% by weight.

25. A process according to claim 24 wherein the concentration of water is in the range 1 to 10% by weight, such as 1 to 6.5% by weight.

26. A process according to any one of claims 21 to 25 wherein the process is carried 5 out as a continuous process.

27. Use of a catalyst system for the production of acetic acid which catalyst system comprises an iridium carbonylation catalyst, methyl iodide co-catalyst, optionally at least one of ruthenium, osmium, rhenium, zinc, gallium, tungsten, cadmium, mercury and indium and at least one non-hydrohalogenoic acid promoter.

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